Submission 13

Preliminary Estimates of River Response Times to Drawdown
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Timeframe given is for ***initial response*** based on ideal, natural characteristics (magnitude, timing, duration) of lower Snake River hydrologic regimes (baseflows, bankfull flows [1:1 to 1:2 years], riparian flows [1:2 to 1:20 years], floodplain flows [1:20 to 1:100 years]). These flow regimes will continue to be regulated by upriver dam operations (i.e., Dworshak, Hells Canyon). Initial response will depend on the initial flow regimes provided by dam regulation, as well as the type of water year (i.e., drought vs. wet); for example, an initial 5% exceedence flow versus an initial 90% exceedence flow will dictate the range of initial responses.

Changes in river processes will likely be slow and subtle, and may take decades to be observed. Attributes are highly interrelated, and not independent. For example, the development of complex channel morphology depends on the river's competence (a function of flow regime and sediment budget) to mobilize channelbed surfaces.

Attribute	Description	Ecological Significance	Timeframe for Initial Response	Comment
Natural variability in flows and water quality	Natural periodicity, duration, and seasonal timing of baseflows, spring/summer runoff, and winter floods	• Inundation of bar features during dispersion of riparian plant seeds discourages germination on bars • Variable water depths and velocities over spawning gravels during salmonid spawning spatially distributes redds • Inundation of alternate bar margins, including backwater scour channels, creates shallow slack water areas between late-winter and snowmelt periods for early life stages of salmonids and amphibians • Provides favorable ranges of baseflows for maintaining high quality juvenile salmonid rearing and macroinvertebrate habitat within an alternate bar morphology • Provides late-spring outmigrant stimulus flows • In general, optimizes salmonid physical habitat availability for all seasons • In general, restores groundwater/surface water dynamics • In general, restores floodplain/riparian processes associated with a snowmelt hydrograph	2+ years	Dependent on operation of upriver dams

Attribute	Description	Ecological Significance	Timeframe for Initial Response	Comment
Balanced fine and coarse sediment budgets	Fine and coarse sediments are exported at rates approximately equal to sediment inputs. Channel morphology is maintained in 'dynamic quasi-equilibrium'	• Reduced fine sediment storage and maintained coarse sediment storage improves spawning habitat quality without reducing quantity • Mobilization of coarse sediments and preventing mainstem accumulation of fine sediments increases pool depths for adult salmonid cover and holding, and improves physical complexity through bar evolution • Reduced fine sediment storage in banks lessens bank accretion, thereby allowing continual evolution of channel morphology • Discouraging bed elevation aggradation at tributary deltas maintains salmonid migration corridors	5-10+ years	Analysis of Lower Granite Reservoir fine sediment erosion and export – not total sediment budget. See Hanrahan et al. (1998) for detailed description.
Frequently mobilized channelbed surface	Coarse sediment surfaces are mobilized by the bankfull discharge, which on average occurs every one to two years	• Reduced substrate embeddedness in riffle/run habitats increases survival of eggs and emerging alevins • Scouring and reduced sand storage in pools creates greater pool depths/volumes for adult fish cover and holding • Provides turnover of spawning gravel deposits and mobilizes those deposits several layers deep • Provides greater substrate complexity in riffle and run habitats for improved macroinvertebrate production • Decreases riparian encroachment by scouring seedlings on bars • In general, increases micro-habitat complexity	2+ years	Hanrahan et al. ongoing research. Dependent on flow regime and channel hydraulics.
Spatially complex channel morphology	Alternate bar morphology, side channels and backwater areas, asymmetrical cross sections, etc.	• Diverse salmonid habitat availability for all life stages over wide ranging flows • Supports diverse and productive biological communities • Develop and maintain diverse riparian plant communities in all stages of successional development	1-50+ years	A continuum of complexity will be expressed, dependent on flow regime and channel hydraulics; ranging from a near-immediate increase in complexity (e.g., asymmetrical cross-sections) to a 50+ yr. flow event causing channel migration and avulsions.

Attribute	Description	Ecological Significance	Timeframe for Initial Response	Comment
Periodic channelbed scour and fill	Channelbed and bars are scoured deeper than the coarse surface layer by floods exceeding three to five year annual maximum flood recurrences	• Scouring below bed surface layer rejuvenates spawning gravel deposits • Facilitates bar evolution (e.g. alternate, medial), improving channelwide spawning and rearing habitat complexity • Maintains and/or improves pool depths for adult salmonid cover and holding • Increases diversity of surface particle size distributions • Removes vegetation from bar surfaces, discouraging riparian plant encroachment and bank accretion • Deposits fine sediment onto upper alternate bar and floodplain surfaces, thereby reestablishing dynamic riparian stands of vegetation in various stages of succession	5+ years	Dependent on flow regime and channel hydraulics.
Periodic channel migration	'typical' bank erosion rates, floodplain deposition every three to five years, and channel avulsions every ten years on average.	• Diverse age class structure of woody riparian vegetation, producing and maintaining early-successional riparian communities • Increase in woody riparian overstory and understory species diversity • Increased habitat quality and quantity for native vertebrate species dependent on early successional riparian stands • High flow refuge and summer thermal refuge for amphibians and juvenile fish provided in rejuvenated scour channels • Salmonid habitat complexity is improved through creation of sloughs and side channels • Increasing micro-habitat complexity from input of large woody debris caused by bank erosion	5-10+ years	Dependent on flow regime and channel hydraulics.
Infrequent channel resetting floods	Those that exceed the ten to twenty year annual maximum flood recurrence	• Salmonid habitat complexity and quantity is improved through deep scour of channel features, significant channel migration and avulsion (creating sloughs and side channels), and alternate bar scour and redeposition • Maintains riparian vegetation dynamics, such as varying stages of successional development	20+ years	Dependent on flow regime and channel hydraulics.

Attribute	Description	Ecological Significance	Timeframe for Initial Response	Comment
		• Disturbs bar surfaces close to channel center to discourage riparian encroachment • Provide habitat for riparian-dependent amphibian, avian, and mammalian species • Improves bedload routing by minimizing impedance of bedload transport past tributary deltas		
Naturally-fluctuating groundwater table	Groundwater fluctuations in floodplains, terraces, sloughs, and adjacent wetlands occur similarly to regional unregulated river corridors	• Maintains off-channel habitats including overflow channels, oxbow channels, and floodplain wetlands • Promotes diversity of habitat types within entire river corridor • Forms and maintains hyporheic habitats	3-5+ years	Dependent on flow regime and channel hydraulics – surface water/groundwater interactions.
Functional floodplain	Areas where fine sediments can be removed from the inner channel and deposited.	• Through scour and deposition, floodplain construction rates roughly equal floodplain loss as channel migrates • Provides sufficient channel confinement such that hydraulic processes can be maintained • Increases hydraulic roughness, and allows greater flow storage during high magnitude floods • Maintains riparian vegetation dynamics, such as varying stages of successional development	3-5+ years	Dependent on flow regime and channel hydraulics.
Self-sustaining diverse riparian plant communities	Successional stages and species composition similar to other regional unregulated river corridors.	• Increase in species diversity, and age class diversity • Increase in riparian habitat complexity • Allows rehabilitation of evolving channel features (e.g. alternate bars, sloughs) • Vigorous woody riparian corridor moderates physical effects of extreme floods • Increases availability of habitat for riparian-dependent amphibian, avian, and mammalian species • Moderates water temperatures at the micro-habitat scale	3-20+ years	Dependent on plant species composition, as well as flow regime and channel hydraulics (e.g., bar scour, floodplain inundation, channel migration).